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GAS ABSTRACTS

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1. GAS INDUSTRY

LP-Gas Industry

Benz, G. F. L.P.G.—SUPPLY AND DEMAND OUTLOOK. *Oil Gas J.* **46**, 92, 94-95 (1947) *May* 24.

Data are given for sales and prices of LP-gas. Although there has been considerable increase in demand in the last few years, it is felt that the supply will, in general, be adequate to meet these demands. However, the LP-gas industry has an unbalanced demand curve since consumption is very high in winter. For this reason several companies are studying various means of storing large volumes for peak demand supply.

R. S. Goodrick

LP-Gas Regulations for Vessels

OPERATING CODE FOR VESSELS APPROVED BY COAST GUARD. *LP-Gas* **7**, 71 (1947) *June.*

Regulations governing the use of LP-Gas for cooking and heating on non-passenger carrying vessels of U.S. registry were published April 24, 1947, and will be effective on July 24, 1947, according to Coast Guard Headquarters. All appliances used aboard vessels must be approved by the American Gas Association Testing Laboratory, fittings must bear Underwriters Laboratories stamp and storage must be in ICC containers. All appliance, storage and regulator installations must be approved by the Commandant of the Coast Guard. No procedure for obtaining this approval was outlined.

Excerpt from article.

Synthetic Fuel Industry

RECENT DEVELOPMENTS IN FUEL TECHNOLOGY. *Chem. Eng.* **54**, 127-132 (1947) *April.*

The expanding market for petroleum as a liquid fuel for all types of transportation as well as for heating purposes, and the increased production costs of crude petroleum emphasize the possibilities of building an American synthetic fuel industry. Reserves, gasification processes and research developments which may make economically possible the interchangeability of gas, liquid and solid fuels are reviewed briefly.

C. H. Riesz

The following article, which has not been abstracted, is called to your attention:

Reed, P. "BIGGEST INCH" EMPLOYS ADVANCE IDEAS LAYING LARGE LINES. *Oil Gas J.* **46**, 58-60 (1947) *June* 7.

2. APPLIANCES

Air Conditioning

Phillips, L. R. AIR DISTRIBUTION MAKES OR BREAKS AIR CONDITIONING. *Power Plant Eng.* **51**, 73-75 (1947) *May.*

An explanation of the operation of the Anemostat and its usefulness in heating and air conditioning.

E. F. Davis

Bimetallic Thermal Elements

A STUDY OF BIMETALLIC THERMAL ELEMENTS. *Am. Gas Assoc. Testing Lab. Bull.* **42**, 1-25 (1947) *February.*

A report is given of American Gas Association laboratory tests on bimetal thermal elements used in connection with controls. Results indicate there is no desirable bimetal for use above 800°F. Recommendations have been made to manufacturers that the elements should be protected to prevent local heating and resultant distortion of the bimetallic element.

E. F. Davis

Burners

Minchin, L. T. AERATED BURNERS OF HIGH STABILITY. *Gas in Industry* 1947, 2-9 (*February*). (*Section of Natl. Gas Bull. Australia* 11 (1947) *January-February*).

A discussion is presented of "self inspirating" gas burners with proposals for improving the present methods of utilizing this type of burner. Methods of preventing "flash back" and the design factors of self extinguishing ejectors are related. A "perignitable" burner (so called because it is ignited through the air shutters) is proposed as being feasible for aerated burners. Factors to be considered in the design of flame-proof burner heads are enumerated in detail.

E. F. Davis

Causes of Poor Baking

Huck, J. CORRECTION OF BAKING COMPLAINTS. *Am. Gas Assoc. Monthly* 29, 219-221 (1947) *May.*

On the basis of complaints made by housewives to Home Service Departments, American Gas Association Testing Laboratories have made a study of the causes of baking failures. Improved oven design has eliminated many types of complaints, but those remaining may be caused by: (1) lack of adjustment of the stove, or (2) improper procedure by the baker. A stove that does not sit level, burners with improper primary air adjustment, or leaks around a warped oven door are common causes of unsatisfactory results. When these are eliminated, most poor results are due to improper preparation of the batter, use of pans of the wrong size or of unsuitable material, incorrect spacing of pans in the oven or baking at too high or too low a temperature.

S. Dean

Interchaneability of Fuel Gases

Knoy, M. F. MASTER INTERCHANGEABILITY CHART. *Gas* 5, 46-52 (1947) *June.*

Mr. Knoy has prepared a master chart for the purpose of determining the interchangeability of all of the common fuel gases. It is based on his own well known formula rather than on any of the more complicated expressions.

J. D. Parent

Noise of Extinction

RESEARCH IN FUNDAMENTALS OF NOISE OF EXTINCTION OF LARGE GAS BURNERS. *Am. Gas Assoc. Testing Lab. Bull.* 41, 1-26 (1947) *February.*

Results of American Gas Association laboratory tests show no effect on the noise of burner extinction with primary air adjustment of 55% or less; above this value noise of extinction increases. The smaller the slope of the injecting venturi, the louder the noise of extinction is. Other factors are the burner temperature and the per cent secondary air in the combustion area.

E. F. Davis

Pilot and Control Stoppages

Gellert, N. H., Jr. PILOT AND CONTROL STOPPAGES IN MANUFACTURED GAS SYSTEMS. *Gas* 5, 29-31 (1947) *June.*

A discussion is given of the methods of possible removal of stoppages from pilots and controls. Removal by use of accessories, distribution control, and removal at source are discussed in detail.

E. F. Davis

3. COMBUSTION AND INDUSTRIAL FURNACES

Coal Substitute

OIL SPRAYED COKE BREEZE FOR BOILERS. *Coke & Gas (British)* 9, 128-130 (1947) *May.*

A simple, automatic method of spraying waste oil on coke breeze has been developed at the Chelmsford works of Crompton Parkinson, Ltd. The oil sprayed coke breeze was found to be a good substitute for coal in the firing of two Paxman dry-back Economic boilers. Diagrams are included.

C. Von Fredersdorff

Coke Ignition

Roberts, J. TESTING DOMESTIC COKE. *Coke & Gas (British)* 9, 148-149 (1947) *May.*

A series of tests carried out by the Severn Valley Gas Corporation on different cokes and using various methods of ignition such as wood or gas fire are reported. Intensity of radiation was measured as a function of time by a suitable radiometer. Use of excess gas showed a retarding effect on the speed of ignition. A method and apparatus are described for determining the relative ease of ignition.

C. Von Fredersdorff

Furnace Atmospheres for Sintering

Webber, H. M. and Hotchkiss, A. G. FURNACE ATMOSPHERES FOR SINTERING. PART I—HYDROGEN. *Industrial Heating* 14, 742-744, 746, 748, 750, 752, 754 (1947) *May.*

The development and control of suitable furnace atmospheres for use in sintering of powdered metals is of considerable scope and interest. Controlled atmospheres such as hydrogen, carbon monoxide, dissociated ammonia, and partially burned fuel gas are employed in sintering furnaces to prevent undesirable chemical reactions during the heating and cooling processes. Electrolytic hydrogen, important for its low oxygen content, is purified either by treatment with copper at 1100-1200°F. and with hot ferro-manganese, ferro-titanium or ferro-silicon at 1650-1850°F. or by passing through a palladium catalyst purifier. Water vapor formed by the combination of traces of oxygen with hydrogen is removed by refrigeration or by the usual activated dryers. An equilibrium curve for the reaction $FeO + H_2 \rightleftarrows Fe + H_2O$ is included. Operational techniques for sintering are discussed.

C. Von Fredersdorff

Gas Turbine Design

Smith, R. B. PROBLEMS IN THE MECHANICAL DESIGN OF GAS TURBINES. *J. Applied Mechanics* 14, 99-102 (1947) *June.*

High temperatures involved in the recently developed gas turbine have introduced new problems in selection of working materials and design for stress. The methods used by Elliot Company in the solution of such problems are based on the maximum-stress theory of failure, and the evaluation of working stress is made on the basis of the stress-to-rupture test in simple tension at elevated temperature. Allowance is made in design for a continuous yielding to the extent of 0.5 to 1%. The author gives further consideration to the theory of maximum stress of rupture tests, fatigue fractures, ductility of high temperature materials, and an analysis of bolting materials.

C. Von Fredersdorff

Gas-Turbine Locomotives

EQUIPMENT BEING BUILT FOR COAL-FIRED GAS-TURBINE LOCOMOTIVES. *Power Plant Engineering* **51**, 134 (1947) *June.*

Progress in design and testing of the various phases of coal-burning gas-turbine locomotives has been rapid, and it is expected that actual rail tests of two such locomotives now under construction may be obtained in 20 months. Tests have been concluded on laboratory scale coal atomizing and drying, pulverized coal metering, pressurized combustion, and fly-ash removal. A full-scale coal handling system is being designed and large-scale tests on combustion equipment will be conducted in the immediate future.

C. Von Fredersdorff

Industrial Furnaces

Waight, J. F. and Palser, J. FURNACELESS HEATING AND SMALL GAS FURNACES. *Gas J.* **250**, 344-346 (1947) *May* 14; *Gas World Supplement* **20**, 39-45 (1947) *April* 19.

The American radiant cup and "cell" type burners and the British "C.C." burner giving heat releases up to 30 x 10^6 Btu/cu. ft./hr. at 1900°C. are recent important developments in "furnaceless heating." Applications of small radiant burners in the firing of small heat treating, annealing, and forging furnaces are discussed. Heat transfer rate data and approximate calculations are included.

C. Von Fredersdorff

Oxygen Enriched Blast

Neustaetter, K. OXYGEN ENRICHED BLAST. *Steel* **120**, 110, 112, 133 (1947) *May* 19.

This article, presented before the Blast Furnace and Coke Association, Chicago District, gives results of German and Russian experiments in the field. The article describes and discusses the advantages of oxygen enriched blasts for steel production.

G. M. Platz

Radiant Gas Heating Unit

Kopecki, E. S. GAS HEATING SPEEDS SEAMLESS TUBE PRODUCTION. *Iron Age* **159**, 64-68 (1947) *June* 5.

A reduction in operating costs, increased output and improved quality have been reported by Babcock and Wilcox Tube Company in the production of seamless tubing by utilizing high-speed radiant gas heating. The heating unit, consisting of 12 individual, completely automatically controlled gas furnaces, achieves a heating operation at production capacity and at one-third the cost of conventional heating methods. Manufactured by Selas Corp., this unit offers other advantages such as flexibility of operation and savings in both labor costs and space requirements. A comparison of cost data of the previous and present methods of heating is included.

C. Von Fredersdorff

Textile Processing with Gas

Schutt, E. V. K. GAS USES IN TEXTILE PROCESSING. *Gas* **5**, 37-39 (1947) *June.*

This article gives an elaborate description of the applications of gas in the textile industry along with some cost analysis between steam, electricity and gas.

E. F. Davis

4. CARBONIZATION AND GASIFICATION

By-Product Coking

RECENT DEVELOPMENTS IN BY-PRODUCT COKING. *Coke & Gas (British)* **9**, 131-137, 149 (1947) *May.*

The author reviews standard American coke oven practice in an effort to show possible ways of increasing British coke oven output. The United States has some 88 active plants comprising 14,580 ovens of which the greater percentage are Koppers and Koppers-Becker. Heating of charge is usually effected by coke oven gas, producer gas, blast furnace gas and miscellaneous gases such as oil gas, propane, and natural gas. The main problem in successful operation is the attainment of an even distribution of heat over the height and length of the tapered ovens; various designs for burners using rich and lean gas, and flue arrangements have evolved with varying degrees of success. Coke oven capacity is increased usually by adding height rather than length to the oven. The Koppers-Becker, Simon-Carves and the Wilputte ovens are discussed in detail.

C. Von Fredersdorff

Carbonization

COKING DANGEROUS COALS. *Coke & Gas (British)* **9**, 145-147 (1947) *May.*

The use of silica brick as a lining for coke ovens has virtually stopped salt corrosion of oven walls. With the use of larger ovens and higher temperatures, necessitated by increased labor costs since the war of 1914-1918, another difficulty arose; namely, that of damage to oven walls through the pressure exerted by the coal charge during carbonization. The maximum pressures are recognized as occurring when the fusion zone has reached the center of the charge. Damage to oven walls is also frequently due to excessive pressure of the ram rod during pushing, broken and otherwise faulty charges, and use of adjacent compressed and top-charges. Recommendations to prevent wall damages include (1) provision for top charging an oven at convenient points should the original charge break, (2) gradual introduction of compressed-charging where top-charging equipment is available, (3) careful regulation of flue temperature at the break point of a broken charge, (4) provision for varying the width of the charge. Further details of operation are noted and a specific case relating to the manufacture of coke for carbon electrodes is cited.

C. Von Fredersdorff

Coal Distillation

SMOKELESS FUELS FROM WESTERN COALS. *Industrial Trends* **4**, 7 (1947) *June* 15.

K. L. Storrs and G. W. Carter have developed a process for both low and high temperature distillation of coal; a method consisting in thoroughly agitating a thin layer of coal over a heated surface within a retort and dropping the heated coal particles at any desired temperature into an extrusion unit and on a conveyor. The coal gas obtained is passed through withdrawal pipes and condensed, and various liquid fractions are taken along the length of the pipes. 40% volatile coal can be carbonized to a low temperature coke containing 18 to 22% volatile in approximately one minute. The finished product is a smokeless coal log.

C. Von Fredersdorff

Gasification

Bland, W. F. PROCESSING COAL INTO LIQUID PRODUCTS MAY BE PRACTICABLE IN A FEW YEARS. *Petroleum Processing* **2**, 325-327 (1947) *May.*

The author outlines the potentialities of both fluidized and underground gasification techniques with respect to transportation of fuels, increased rates of production of fuel, fuel reserves, and the economic relationship.

G. M. Platz

Oil Gas in Continuous Vertical Retorts

Burton, A. H. OIL GAS IN CONTINUOUS VERTICAL RETORTS. *Gas J. (British)* **250**, 132 (1947) *April* 16.

Experiments on continuous vertical water gas retorts into the top of which steam and oil mixtures were introduced continuously, causing a concurrent production of coal gas, oil gas, and blue water gas, indicate that a saving of 5% of coal requirements and an increase in calorific value of the gas from 466 to 629 can be realized by the use of oil at the rate of 10.5 gallon per retort for a retort having a 7 ton coal per day nominal rating. Gas analyses show an increase in unsaturates and methane with an increase in oil input. A lighter tar is obtained with the use of oil.

C. Von Fredersdorff

Sulfur Resistant Catalysts

Batchelder, H. R. SULFUR RESISTANT CATALYSTS. *Am. Gas Assoc. Monthly* **29**, 222-225, 232 (1947) *May.*

A summary is presented of work done at the Institute of Gas Technology on the activity of molybdenum preparations, nickel compounds and miscellaneous catalyst materials in the presence of sulfur compounds in gas making reactions.

R. S. Goodrick

Water Gas Carburetion

PRODUCTION AND CARBURETTING OF WATER GAS IN VERTICAL CHAMBER SETTINGS. *Gas Times* (*British*) **51**, 106-107 (1947) *April* 26.

The material presented in this article is taken from the Swiss *Monatsbulliten No.* 3, *March* 1946 and is an account of the work at the Neuenburg Gasworks, Switzerland. Due to the availability of gas oil over bituminous coal in Switzerland, the Neuenburg Gasworks has developed a process of gasification of crude oil in conjunction with wood charcoal. Gas produced by this method requires intensive scrubbing. The article presents tables giving data on operation and yields.

G. M. Platz

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Carbon Black Production

Burstall, F. H., Lane, F. G. and Ditcham, J. B. CARBON BLACK. *Coke & Gas* (*British*) **9**, 138-142 (1947) *May.*

This article describes an experimental procedure developed in Great Britain for producing carbon black of quality capable of competing with American produced carbon. The procedure described uses the impingement method. Vaporized hydrocarbon oils, mixed with an inert carrier gas, are burned so that the fumes emitted come in contact with a cold rotating drum. The carbon from the flames impinged on the roller and was removed by wire brushes. Many types of hydrocarbons were processed; data on twenty of these are given. The temperatures of the vaporized oil varied between 300 and 350°C. A maximum of 57% of the available carbon in the vaporized oil was collected as carbon black.

G. M. Platz

Compressors

Moore, O. H. OPERATING EXPERIENCES WITH ANGLE TYPE COMPRESSORS. *Am. Gas J.* **166**, 35-37, 56 (1947) *May.*

See *Gas Abstracts* **3**, 94 (1947) *June* for abstract.

Compressors

Shaw, M. C. and Neubauer, E. T. CENTRIFUGAL COMPRESSORS FOR GAS TRUNK PIPE LINES. *Oil Weekly* **125**, 37-41 (1947) *May* 26.

See *Gas Abstracts* **3**, 59 (1947) *April* for abstract.

Conservation

Murray, W. J., Jr. TEXAS GULF COAST HAS EFFICIENT SYSTEM OF GAS CONSERVATION. *Oil Gas J.* 46, 201-202 (1947) *May* 31.

Data are given on the projects for gas conservation in the Gulf Coast region of Texas.

R. S. Goodrick

Corrosion

Buchan, R. C. CORROSION AND PREVENTIVE METHODS IN THE KATY FIELD. *Corrosion* 3, 275-290 (1947) *June.*

Corrosion in oil wells was studied from an operating viewpoint in the Katy Field located 30 miles west of Houston, Texas. A long period of research was necessary due to apparent inconsistency of the observed phenomena. Corrosion most concerned was that taking place in the tubing strings and casing, since these were the most expensive types; however, corrosions at well-head assemblies, meter rams, and gatherings are also discussed briefly. Pitting did not seem to follow any given pattern in the tubing strings and casings, but most severe pitting was observed within 24 inches above the joint couplings. The author explains this by the reflux action of the oil flow due to unsteady film flow at the joints. The economical importance can readily be observed from the author's comment that at above 1500 psi and 160°F., 90 per cent of the condensate wells are subject to corrosion. Methods of protection discussed are chemical injection, putting 2 concentric tubing strings in the casing, and coating the tubing and inner wall of the casing with an available plastic coating. The last seemed the most promising method.

S. Mori

Corrosion

Huddleston, W. E. RESULTS OBTAINED FROM FIVE YEARS OF CATHODIC PROTECTION ON 24-INCH GAS LINE RAPIDLY DETERIORATING FROM BACTERIAL CORROSION. *Corrosion* 3, 1-7 (1947) *January.*

A five mile section of a 24 inch welded gas transmission line crossing under the North Canadian River and passing through the swamp area by the river in Oklahoma reached a high leakage frequency during the eleventh year of service. The pit-holes were patch welded. Tests for galvanic corrosion, cathodic interference and electrolysis did not account for such an enormous amount of pitting. Identification of iron sulfide in pits, low concentration of sodium chloride in the soil, the optimum temperature for bacterial growth at the normal coverage depth of the pipeline all indicated microbiological corrosion. According to Hadley, the basic theory underlying the micro-biological corrosion is similar to the electro-chemical theory; therefore, a 35 ampere cathodic rectifier was installed and adjusted until there was a pipe to soil potential of over 1 volt over the affected area. As a result the frequency of one leakage every 10 to 15 days before installation was decreased to 6 leakages during the 26 months following installation; there were no leakages during the three years following this period.

S. Mori

Corrosion

Starkey, R. L. and Wight, K. M. ANAEROBIC CORROSION OF IRON IN SOIL. *Corrosion* 3, 227-232 (1947) *May.*

The *Sporovibrio desulfuricans* bacteria is responsible for anaerobic corrosion of iron and steel. It consumes molecular hydrogen and reduces the sulfates present in the soil to H_2S. The H_2S combines with the anodic solution of iron to produce $Fe(OH)_2$ and FeS. Today this type of corrosion is being realized as economically important, so an attempt is made to detect it in the soil by measuring its pH and its oxidation reduction (redox) potential in the vicinity of the anaerobic corrosion. The presence of sulfates and organic matter are also good indicators for the bacterial growth; however pH and redox potential measurements are easier to obtain. The pH is measured with a glass electrode while the redox potential is measured with a platinum-calomel half cell. Tests can be made in the soil in situ by pushing a four

foot plastic tube containing the electrodes to the desired depth. As a result of many field tests, it was found that anaerobic corrosion took place in the pH range 5.5 to 8.5, and the severity of corrosion may be classified as to the number of millivolts potential; however, these values are arbitrary as yet, and in a test of 48 sites where other types of corrosion are at a minimum, 12 sites showed severe corrosion, and 15 sites showed moderate corrosion. The redox potential measurements estimated 67% of these cases correctly and 23% within a fair degree of accuracy, while in 10% of the cases the estimation was poor. Changes in the level of the soil water table, presence of consumer gas or hydrogen, and variation in drainage interfered with redox potential measurements. There was no consistent correlation between the texture of the soil or the acid extract of the soil with the severity of corrosion. Tests also showed that cellulose acetate was resistant to soil microorganisms.

S. Mori

Corrosion Prevention

Statham, T. R. NOVEL GROUNDBED FOR CATHODIC PROTECTION. *Petroleum Engr.* 18, 53-54 (1947) *April.*

73 leakages occurred on three 8″ pipes and one 10″ pipe on a line within four miles south of Corsicana, Texas between 1933 and 1942. During this period the 8″ pipes were completely reconditioned while the 10″ was partially reconditioned. A grease coating wrapped with a special rag on the 8″ pipeline, and a wax asphalt coating machine wrapped with special asbestos met with little success. Measurements on soil resistance, pH, soil classification, and pipe to soil potential as shown graphically in this article disclosed the soil in this area to be severely corrosive. In 1942 a continuous cathodic protection was installed. The work was hampered by the critical need of the material for the armed forces, so that a limited supply of junk pipe was available, and the cables obtainable had to be hand insulated. The latter was the weakest link of the unit as disclosed in 1946 when the unit was examined. In its installation, 20 feet of junk pipe ground bed is welded on the cables that are connected to the pipeline. There are also rectifiers connecting the power line to the pipeline. Further details on the installation are described in the article. The rectifiers were adjusted to give 1.03 milliamps per sq. ft. of pipe surface, but this was later decreased to 1.00 milliamp. Between 1942 and 1946 only one rust hole appeared on the pipeline. In 1946 when materials again became available, the ground bed tonnage was increased, and the hand insulated copper cable was replaced by a machine insulated cable since there were several leakages and the rectifier output was falling off. After several weeks, it was found that only 0.72 milliamps per sq. ft. of pipe surface was adequate for effective protection. This is shown by a curve representing the pipe soil potential at different locations.

S. Mori

High Pressures in Wells

Watts, E. V. SOME ASPECTS OF HIGH PRESSURES IN THE D-7 ZONE OF THE VENTURA AVENUE FIELD. *Petroleum Technology* 10, T.P. 2204 (1947) *May.*

The author points out that the pressure in this field approximates the geostatic value. Possible causes are related. Well behavior is briefly treated.

J. D. Parent

House Heating Load

Peck, I. K. PROBLEMS OF THE HOUSE HEATING LOAD. *Am. Gas Assoc. Monthly* 29, 265-269, 312 (1947) *June.*

This article tells the overall problem of meeting the house heating load and gives a method of estimating the peak load.

E. F. Davis

Pipe Line Inspection

Leamon, G. F. PIPE LINE AERIAL PATROL. *Gas Age* 99, 27, 36, 38 (1947) *May* 29.

Air patrol is conducted at speeds of about 100 mph and is very effective in locating minute leaks and other dangerous conditions such as high water, eroding fields and construction endangering lines. Whereas ground patrol costs about one dollar per mile, air patrol costs about 16 to 20 cents per mile. The range of vision is greatly increased.

J. D. Parent

Production for Peak Load

RECENT DEVELOPMENTS IN THE PRODUCTION OF HIGH BTU GAS FOR MIXING WITH NATURAL GAS. *Am. Gas J.* 166, 11-14 (1947) *May.*

This article describes methods employed in various localities for supplementing the peak loads on transmission lines by local production of suitable gases for mixing, or which when used alone, are of a quality consistent with natural gas. The use and construction of carburetted water sets, standard or modified for conversion of coke and oil or oil alone are described. Several tables giving yields and analytical results are included.

G. M. Platz

Proration

Smith, S. CARTHAGE FIELD GAS PRORATION. *Oil Weekly* 126, 42, 45-46, 49, 52 (1947) *June* 2.

Gas proration formulae and their history are presented in detail for the Carthage Field. It is significant that cognizance has been taken of the wastage involved in the determination of open flow deliverability. Bottom-hole pressure is used in the new formula.

J. D. Parent

Recycling

Standing, M. B., Lindblad, E. N. and Parsons, R. L. CALCULATED RECOVERIES BY CYCLING FROM A RETROGRADE RESERVOIR OF VARIABLE PERMEABILITY. *Petroleum Technology* 10, T.P. 2200 (1947) *May.*

On the basis of calculations and some experimentation, the authors reach the conclusion that recycling dry gas at a low pressure leads to greater recovery of higher hydrocarbons than does pressure maintenance and cycling near the dew point. Re-evaporation of liquid at relatively low pressure leads to maximum recovery.

J. D. Parent

Reservoir Behavior

Moyer, V. SOME THEORETICAL ASPECTS OF WELL DRAINAGE AND ECONOMIC ULTIMATE RECOVERY. *Petroleum Technology* 10, T.P. 2201 (1947) *May.*

A method of analyzing reservoir behavior such as depletion history and ultimate recovery is presented. It is not based on pressure equalization but takes into consideration "drawdown" or pressure differential.

J. D. Parent

Transmission

Miller, B. GAS TRANSPORTATION SYSTEM CALCULATIONS. *Gas Age* 99, 28-32 (1947) *May* 29.

The pipe line efficiency concept is useful in design and operation. Causes of pipe line inefficiency include pipe roughness (usually due to dirt, foreign matter and corrosion), joints, valves, fittings, bends, etc. Suggested allowances for these are given. Some elements of the theory of pipe flow resistance are briefly described in this fifth article of a series.

Author's abstract

Underground Storage

Dahlgren, E. G. UNDERGROUND NATURAL GAS STORAGE. *Gas Age* **99**, 18-19, 36 (1947) *May* 29.

Underground storage is one of the answers to the gas shortage during the winter season. Depleted or partially depleted gas and oil fields receive gas from pipe lines during the summer and at times when demand is low. Small pools containing not over two to three billion cu. ft. at 500 psi are recommended for high deliverability during times of peak load, while big pools are recommended for steady withdrawal during winter months. Data on present underground storage practice are given according to states and companies.

J. D. Parent

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Catalytic Desulfurization

Amero, R. C. and Wood, W. H. CATALYTIC DESULFURIZATION OF CRACKED AND STRAIGHTRUN GASOLINES. *Oil Gas J.* **46**, 82-85, 99 (1947) *May* 24.

To illustrate that no general conclusion can be made regarding the relative efficiency of fuller's earth and bauxite as desulfurization catalysts, the authors present tables showing the results of (1) a space velocity temperature study to determine optimum operating conditions; (2) a series of runs on a given cracked gasoline to determine the relative catalytic activities of various clays and bauxites, and (3) a study of the catalytic effects of fuller's earth and bauxite on the treatment of several cracked and straightrun gasolines. Data are presented showing the relationship between sulfur content and octane number with throughput for various catalysts, but no comparative evaluations are made.

B. Grimm

Fischer-Tropsch Synthesis

NEW CO-H_2 CONVERTER PROVIDES BETTER TEMPERATURE CONTROL. *Chem. Ind.* **60**, 793 (1947) *May.*

The Bureau of Mines has been investigating the removal of the heat of reaction in the Fischer-Tropsch conversion by means of passing a liquid coolant in parallel flow with the synthesis gas (CO-H_2). The highest space-time yield is about one-half that attainable with a fluidized catalyst reactor although it is estimated that costs are about the same. A fraction of the liquid product, boiling range 230-257°F., is used at a pressure of 100-150 psi gauge pressure to maintain the reaction temperature at about 392°F. Runs of over 600 hours duration have been made in a gallon per day pilot plant which has been operating during the last 18 months.

C. H. Riesz

Fischer-Tropsch Process in Germany

Hall, C. C. THE OPERATION AND DEVELOPMENT OF THE FISCHER-TROPSCH AND SIMILAR PROCESSES IN GERMANY. *Chemistry & Industry* **1947**, 67-75 (*February* 1).

A generalized discussion of the Fischer-Tropsch process in Germany is presented. The data for atmospheric and medium pressure are compared. Costs for the medium pressure synthesis were somewhat higher than for the atmospheric process; in both, the major cost was that of generating synthesis gas. Various developments on iron catalysts, iso-synthesis, ruthenium catalysts and product utilization are reviewed.

C. H. Riesz

Chemicals from Petroleum

CHEMICALS FROM PETROLEUM. *Petroleum (British)* **10**, 102-105 (1947) *May.*

Since its discovery in commercial quantities in the middle of the nineteenth century, petroleum has been used to an ever-increasing extent as a source of illuminants, lubricants and fuels. Today, while the consumption of oil for these purposes is still rapidly expanding, a new trend is in evidence. Crude oil has been recognized to be a potential source of very valuable chemicals and the basic substance from which a great number of essential synthetic materials—including rubber and plastics—can be made. The far-reaching expansion of the Shell Petroleum Company's operations is a significant example of this trend which seems likely to provide Britain with a valuable new industry at a time of need.

Editor's abstract

Thermal Cracking

Armistead, G., Jr. THERMAL CRACKING OF RESIDUAL FEED STOCKS TO LIQUID RESIDUES. *Oil Gas J.* 45, 94, 96, 101, 104, 115 (1947) *April* 19.

In thermal cracking practice the most significant developments have been in viscosity-breaking, selective cracking and gas reversion or Polyform processes. The various processes are descibed briefly.

C. H. Riesz

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7. ANALYTICAL METHODS AND TESTS

Carbon Monoxide Determination

Shepherd, M. DETERMINATION OF SMALL AMOUNTS OF CARBON MONOXIDE IN AIR BY VARIOUS REFERENCE METHODS. *J. Research Natl. Bur. Standards* 38, 351-358 (1947) *May* 31.

This is a report of a study of cooperative analyses of two standard samples of carbon monoxide in air, by reference methods used in laboratories working for the Armed Forces. The methods used were: Roughton, colorimetric, calorimetric, iodometric, acidimetric, and gravimetric. The data obtained from these methods is tabulated and analyzed; the practical considerations involved in their use are discussed.

M. Nolt

Hydrocarbon Mixtures Analysis

Kent, J. W. and Beach, J. Y. INFRARED SPECTROMETRIC QUANTITATIVE ANALYSIS OF MULTICOMPONENT LIQUID HYDROCARBON MIXTURES. *Anal. Chem.* 19, 290-293 (1947) *May.*

Studies involving complex liquid hydrocarbon systems are handicapped by the difficulty attending separation and identification of the separate species. Infrared spectra of the individual hydrocarbons are usually of such a degree of complexity that preliminary separation of mixtures of many compounds must usually precede the analysis. Several distillation techniques are described by which the hydrocarbon system may be separated into cuts of nine to twelve components. Identification is by comparison with standard spectra. A technique for computing the concentration of each component in each cut is described. In spite of the deviation of some components from Beer's Law, the separate cuts may be analyzed with an accuracy of 1%.

S. Katz

Organic Sulfur Removal

Priestley, J. J. and Morris, H. I. ORGANIC SULFUR COMPOUNDS IN TOWN GAS AND THEIR REMOVAL. *Gas Times (British)* 50, 396-399 (1947) *March* 29.

The authors give a history of the removal of organic sulfur compounds from town gas. A

detailed report of the Holmes-Maxted Catalytic Sulfur Removal Plant using a copper thiomolybdate catalyst is given. The details of control, results, and a description of the working condition of the plant after two years of operation are included. A discussion is presented dealing with the desulfurization of crude gas by treatment with oxide boxes and by liquid purification.

C. Hummel

Oxygen Determination

Aluise, V. A., Hall, R. T., Staats, F. C. and Becker, W. W. OXYGEN IN ORGANIC COMPOUNDS. *Anal. Chem.* 19, 347-351 (1947) *May.*

The direct microdetermination of oxygen in organic compounds by the Unterzaucher method is discussed in detail. The procedure involves pyrolysis of the compound in a stream of nitrogen, conversion of all the oxygen in the pyrolysis products to carbon monoxide over carbon at 1120°C., and oxidation of the carbon monoxide to carbon dioxide by iodine pentoxide. The equivalent amount of iodine liberated from the iodine pentoxide is determined titrimetrically by oxidation to iodate, subsequent reduction to iodine, and titration with sodium thiosulfate solution. The method requires less elaborate apparatus than either the complete combustion or the catalytic hydrogenation method. Catalyst poisoning is not a problem and the presence of other elements has no effect on the applicability of the method. Specifications for the apparatus and reagents are given. Tables are included showing the results obtained using different types of carbon and iodine pentoxide preparations, and comparisons of determinations obtained directly and by difference.

M. Nolt

Sulfur Dioxide Determination

Grant, W. M. COLORIMETRIC DETERMINATION OF SULFUR DIOXIDE. *Anal. Chem.* 19, 345-346 (1947) *May.*

This method for the quantitative determination of sulfur dioxide in concentrations of 0 to 10 micrograms per milliliter of solution gives results which are accurate to 0.1 microgram for pure solutions. Mercuric chloride is used to remove interfering substances found in alkaline extracts of animal tissues, and a preliminary distillation removes those substances interfering with the determination of sulfur dioxide in fruit.

C. Hummel

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8. GENERAL AND PHYSICAL CHEMISTRY

Thermodynamic Properties of Ammonia-Water Mixtures

Scatchard, G., Epstein, L. F., Warburton, J. Jr. and Cody, P. J. THERMODYNAMIC PROPERTIES—SATURATED LIQUID AND VAPOR OF AMMONIA-WATER MIXTURES. *Refrig. Eng.* 52, 413-419 (1947) *May.*

Equations used to calculate the thermodynamic properties of saturated liquid and vapor of ammonia-water mixtures are presented. Calculated values of enthalpy, entropy, free energy, and availability, as well as vapor pressure data are presented in tabular form.

H. T. Inatomi

Steam-Carbon Reaction

Godsby, J., Henselwood, C. N. and Sykes, J. K. W. THE KINETICS OF THE REACTION OF THE STEAM-CARBON SYSTEM. *Proc. roy Soc.* (*Series A*), 187, 129 (1946) *October* 22.

The kinetics of the various reactions which

may occur in the steam-carbon system are discussed. The steam-carbon reaction, the primary product of which is carbon monoxide, is of fractional order with respect to steam and strongly retarded by hydrogen. The carbon dioxide reaction is strongly retarded by carbon monoxide and is of fractional order with respect to carbon dioxide. The rates of both reactions can be represented by

$$\text{rate} = \frac{k_1 p_1}{1 + k_2 p_2 + k_3 p_1}$$

p_1 and p_2 are respectively, the pressures of steam and hydrogen for the steam reaction, and of carbon dioxide and carbon monoxide for the carbon dioxide reaction. The water-gas reaction $CO + H_2O = CO_2 + H_2$ takes place predominantly on the charcoal surface. The forward reaction is of approximately the first order with respect to carbon monoxide and of fractional order with respect to steam; it is retarded by hydrogen and to a lesser extent by carbon dioxide. The reverse reaction is of fractional order with respect to both carbon dioxide and hydrogen, retarded by steam and unaffected by carbon monoxide. Both components combine to give the thermodynamically correct form of equilibrium constant.

J. Inst. Petroleum (British) 33, 150A (1947) *April.*

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9. ORGANIC CHEMISTRY

Allyl Chloride and Allyl Alcohol Production

Fairbairn, A. W., Cheney, H. A. and Cherniavsky, A. J. COMMERCIAL SCALE MANUFACTURE OF ALLYL CHLORIDE AND ALLYL ALCOHOL FROM PROPYLENE. *Chem. Eng. Progress* 43, 280-290 *"Trans. Section"* (1947) *June.*

The effects of important reaction variables in allyl chloride production were evaluated in an 1800 lb. of allyl chloride/day pilot plant. At 500-510°C. the reaction is rapid and nearly complete, higher temperatures giving undesirable side reactions. Residence time has little influence on the composition of the product in the range 1.8 to 3.6 seconds. Pressure has only a small effect on the course of the reaction in the range 10 to 30 lb./sq. in. ga., 15 lb./sq. in. ga. being used commercially. The reactor design, an important factor in obtaining optimum yields of allyl chloride, is not disclosed. Pilot plant studies of the hydrolysis of allyl choride to produce allyl alcohol are presented. Materials of construction and corrosion problems are discussed briefly.

C. H. Riesz

Pure Hydrocarbons

Howard, F. L., Mears, T. W., Fookson, A., Pomerantz, P. and Brooks, D. B. PREPARATION AND PHYSICAL PROPERTIES OF SEVERAL ALIPHATIC HYDROCARBONS AND INTERMEDIATES. *J. Research Natl. Bur. Standards* 38, 365-395 (1947) *March.*

Pure paraffin and olefin hydrocarbon liquids were prepared in quantities sufficient for engine tests. The report describes the methods of preparation of 29 paraffin hydrocarbons and 21 olefin hydrocarbons and a number of alcohols, ketones, esters and alkyl halides. Physical constants of the pure compounds are tabulated.

C. H. Riesz

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10. CHEMICAL ENGINEERING

Air Flow Measurement

Wile, D. D. AIR FLOW MEASUREMENT IN THE LABORATORY. *Refrig. Eng.* 53, 515-521 (1947) *June.*

A discussion of design details for an improved method of air measurement in connection with air conditioning equipment. Frictional resistance of perforated plates, nozzle design and coefficient of discharge are presented in detail.

E. F. Davis

Column Design

Edmister, W. C. FLUIDYNAMICS AND THERMODYNAMICS OF HYDROCARBON SEPARATION PROCESSES. *Calif. Oil World* 40, 9, 11, 13, 15 (1947) *June* 15.

This is the fourth in a series of articles dealing with column design. The dynamics of column design are presented. A lengthy bibliography is given.

J. D. Parent

Convection Velocities

Silverman, L. CONVECTION VELOCITIES AND THEIR MEASUREMENT. *Heating & Ventilating* 44, 84-92 (1947) *June.*

The laws governing convection currents in both confined and unconfined spaces are formulated and means of velocity measurement described.

Author's abstract

Fluid Flow

Weller, R. THE OPTICAL INVESTIGATION OF FLUID FLOW. *J. Applied Mechanics* 14, 103-107 (1947) *June.*

This paper points out that the methods of photo-elastic stress analysis can be carried over to the study of the flow of fluids by making use of the double refraction developed in viscous shear. The effect is referred to as the "photo-viscous effect." Suitable liquids are tabulated, the method of calibration is described, and qualitative results are shown for a few simple conditions obtained in an experimental liquid tunnel.

Author's abstract

Heat Pump Coefficient of Performance

Parkerson, W. THE COEFFICIENT OF PERFORMANCE OF THE HEAT PUMP. *Heating & Ventilating* 44, 63-67 (1947) *May.*

A thermodynamic analysis of refrigeration cycles is used to compute tables showing the coefficient of performance of the heat pump under different operating conditions. Several approaches to the problem are used: (1) Computations based on the Carnot cycle on a temperature-entropy diagram gives values of the coefficient of performance which are the highest conceivable but actually unattainable. (2) The theoretical cycle shown on a T-S chart approaches somewhat more closely the practical refrigeration cycle but presents an endlessly complicated job of calculating the coefficients of performance. (3) Calculation of the coefficients is enormously simplified by the use of a Mollier diagram on a pressure-total heat chart. The values so obtained are listed in table 2. These are theoretical values based on Freon-12 refrigerant and no losses are considered. Table 3 gives the coefficient of performance for an actual commercial compressor as calculated from a manufacturer's "Performance Ratings." Table 4 is a summary, showing the coefficients of performance as determined by all the previous methods and, in addition, shows the coefficients at 85% compressor efficiency, operated by a motor 85% efficient with 10° sub-cooling of the liquid in the condenser and 10° super-heating of the suction vapor. The coefficient of performance for a resistance-type electric heater is also given. The tables give the coefficients of performance for the compressor unit alone; energy input to the auxiliaries is not considered.

J. J. First

Multicomponent Distillation

White, R. R. and Boyd, W. T. ELEMENTS OF TERNARY DISTILLATION. *Petroleum Processing* 2, 371-373, 375-377 (1947) *May.*

The graphical method of binary systems is applied in part to the distillation calculation of ternary systems. In this manner a relatively clear picture is obtained of the complications of multicomponent distillation not available from numerical calculations.

H. T. Inatomi

Oxygen Production

Conway, M. J. EQUIPMENT FOR LOW COST OXYGEN PRODUCTION. *Petroleum Refiner* 26, 129-133 (1947) *June.*

Production details and a flow sheet for oxygen production by fractionation of liquefied air are presented. Some cost data and possible future uses for cheap oxygen are given.

J. D. Parent

Refrigeration Cycles

Hutchinson, F. W. ANALYZING REFRIGERATION CYCLES. *Heating, Piping, Air Conditioning* 19, 79-81 (1947) *May.*

A simple, straightforward method of extending the pressure-enthalpy chart concept of ideal refrigerating cycle representation to include those deviations which most frequently occur in actual cycles is given here. This chart is particularly suitable for use in showing such deviations since, without exception, they can all be expressed in terms of equivalent series of constant enthalpy and constant pressure processes and hence appear on the chart as either horizontal or vertical lines. To demonstrate this fact more forcefully, an exaggerated example illustrative of actual cycle deviations is presented in detail.

Author's abstract

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Automatic Control Systems

Wehrle, R. H. AUTOMATIC CONTROL OF PROCESSING IS PRODUCT QUALITY INSURANCE. *Petroleum Processing* 2, 365-366, 368-370 (1947) *May.*

Devices for automatic control of temperature, pressure, liquid level, and flow rates are discussed with reference to their advantages and disadvantages in a control system. Pneumatic control systems used in conjunction with the measuring system are also discussed.

H. T. Inatomi

Automatic Remote Control

LaViolette, W. A. AND NOW AUTOMATIC REMOTE CONTROL. *Gas Age* 99, 34-37, 91-92 (1947) *April* 17.

The control system with which this article deals involves the regulation of the flow of natural gas which is supplied throughout northern and central California by the Pacific Gas and Electric Company from the Rio Vista Gas Field Area. The gas flows to the terminus of the line, which is the Oakland Gas Plant, by way of the San Lorenzo Creek Control Station. Since the full capacity of the line is required during the hours of peak demand, it is desired that during the off-peak time the building of line pack, within certain limits of safety, can be achieved between Oakland and San Lorenzo. Because of the requirement of high rates of flow through the San Lorenzo Station with the minimum pressure drop, an electrically positioned 20-in. plug valve is used as the throttling device. Positioning of the valve in San Lorenzo is remotely controlled from the Oakland Gas Plant where operating data is also received and recorded. Automatic remote control is effected by connecting the indicating pressure receiver to the downstream side of the valve and ad-

justing the limit pointers to the band of pressure desired. Then, by positioning the switch to the "automatic" setting, the remote valve is made to follow the desired pressure track.

J. J. First

Heat Pump

Sidler, P. THE HEAT PUMP — USE OF LARGE CAPACITY UNITS IN INDUSTRY. *Refrig. Eng.* 52, 396-400 (1947) *May.*

A discussion of the fundamentals of the heat pump is followed by a treatment of its economy of operation. It is shown in one example that by spending 18.5 heat units in the form of driving power for the compressor, 86 units can be obtained, the difference coming from a low temperature heat source, such as a river or a lake. This ratio of total heat obtained to the heat equivalent of mechanical driving power is the coefficient of performance. It varies as the temperature of the source of heat and inversely with the hot water leaving temperature. The requirements which must be fulfilled to make the heat pump economically feasible are the following: (a) availability of low temperature heat source; (b) moderate temperature difference between the heat source and that required for heating (preferably not exceeding 120-175°F.); (c) high enough heat capacity to permit economical use of centrifugal or axial compressors; (d) high number of operating hours per year and high load factor; (e) low cost of electrical energy for driving the compressor. An undesirable feature of using rivers and lakes as the low temperature heat source is the fact that their temperature varies widely through the year and the coefficient of performance of plants using this source of heat is lowest in winter when the heating load is highest. A desirable heat source is warm waste water from industrial plants, particularly when the water temperature is not high enough for direct heating. Atmospheric air is not a good source of heat because of its wide seasonal temperature variations and also its varying moisture content which may lead to operating difficulties in heat exchangers. The heat pump finds wide applications in Switzerland where cheap electric energy from hydroelectric power plants is available for operating the compressors. The article concludes with operating data for a large heat pump installation in Zurich which incorporates two units called Thermobloc, each having a full load heating capacity of 6,000,000 to 10,000,000 Btu per hour.

J. J. First

Hydrogen-Cooled Generators

Snell, D. S. and Grobel, L. P. NINE YEARS' OPERATING EXPERIENCE WITH HYDROGEN-COOLED GENERATORS. *Power Plant Eng.* 51, 68-72 (1947) *May.*

Since 1937 the General Electric Company has built and placed in service 108 hydrogen-cooled generators with a combined output of over 4½ million kw. The operation of these machines has been highly successful and has fully demonstrated the practicability of hydrogen cooling for turbine generators. Operating benefits of hydrogen cooling are the following: (1) Improved efficiency, due to virtual elimination of the windage losses. (2) Greater output per pound of material and/or reduced operating temperatures, due to the superior cooling properties of hydrogen. (3) Reduced maintenance, due to the exclusion of dirt and moisture from the generator casing, freedom from corona damage, and absence of the fire hazard. The generators are generally operated at ½ psi hydrogen pressure; operation at pressures up to 15 psi permits an increase in the kva output of the generator or a higher temperature of water supplied to the hydrogen cooler for the same operating temperature of the windings. The article is to be continued in a later issue when recent developments in the design of this type of generator will be described.

J. J. First

Process Control

Ziegler, J. G. and Nichols, N. B. INDUSTRIAL PROCESS CONTROL. *Chem. Eng. Progress* 43, 309-314 *"Trans. Section"* (1947) *June.*

Automatic control concepts are introduced. The study of automatic control involves transients rather than steady state conditions. Frequency and magnitude of load changes are important to the quality of control. By means of an average controller it is possible to reduce the rate of load change. Some typical control applications are discussed, and suggestions are given for reducing the time lag. In most processes it is desirable to reduce all but the largest lag, and in some cases it is desirable to reduce the largest lag as well.

H. T. Inatomi

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12. MATERIALS OF CONSTRUCTION

Ceramic Coatings for Steel

Harrison, W. N., Moore, D. G. and Richmond, J. C. CERAMIC COATINGS FOR HIGH-TEMPERATURE PROTECTION OF STEEL. *J. Research Natl. Bur. Standards* 38, 293-307 (1947) *March.*

In addition to the use of the new coatings for the protection of low-carbon steel in various military exhaust systems, there are a number of other possible applications where the new coatings, or modifications thereof, might be beneficial in prolonging the life of steel parts that are subjected to relatively severe temperature conditions. A list of such potential applications would include the following: (1) Domestic stove parts, such as grates or burners, (2) industrial furnace parts, such as mufflers, dampers, or burners, (3) parts for heat interchangers, (4) heat baffles for continuous enameling furnaces, (5) annealing boxes, and (6) mufflers and tail pipes for buses, trucks, and automobiles.

Excerpt from article

Corrosion in Petroleum Processes

Wilkinson, E. R. MECHANICAL AND METALLURGICAL CONTROL OF SULFURIC ACID CORROSION IN PETROLEUM PROCESSES. *Corrosion* 3, 252-262 (1947) *May.*

In order to control corrosion due to sulfuric acid in the petroleum refining process, the principal factors which exert influence on this type of corrosion and the accumulation of data from past experiences on different operations have been studied. Five known basic factors which exert such an influence are concentration of the acid, temperatures, oxygen dissolved in the solution, turbulence and high velocities of the acid flow, and electrolytic action. Methods of controlling these factors are discussed with reference to different types of materials used. Discussions of some factors are accompanied by curves illustrating their effect. These estimations are general and may not always apply to any specific case. Plant operations involving acid treating, alkylation, acid reclaiming, acid separating, and acid concentrating are discussed with reference to the five basic factors, and also to past experiences as to the correct materials that should be used on various parts of the units. A table summarizing these results also accompanies this article. Some materials, resistant chemically under severest operating conditions, but limited by fragility, ductility, strength, economical and material availability are illustrated in the article. In conclusion, the author stresses the performances of the different materials on various parts of the unit in operation rather than laboratory test data in actually finding out the durability of the tested materials.

S. Mori

Corrosion of Concrete

Taylor, S. B. and Hutchinson, G. H. CORROSION OF CONCRETE CAUSED BY SULPHUR-OXIDISING BACTERIA. *J. Soc. Chem. Ind.* 66, 54-57 (1947) *February.*

The interior of two concrete draught cooling towers were able to resist the growth of sulfate forming bacteria for 12 years, perhaps due to its high pH; but at the end of this period there were signs of moderate corrosion in localized areas. The badly affected areas were either white colored and easily scraped off or else they were brown colored resistant films on the concrete surface. The corroded area had relatively low pH value, high sulfate content, and there were 1,000,000 bacteria per gram of corroded material. The circulating water was also found to contain 1,000,000 bacteria per ml. of water. The two types of corroded material were scraped off and the material was then put into a sulfate bacteria media and grown. After repeated transfers a pure strain was obtained. Test concrete samples immersed in it showed marked corrosion in three weeks. The economical aspect of this type of corrosion is serious and preventative measures are suggested.

S. Mori

Corrosion of Steel

Uhl, W. C. NEW THEORY FOR CORROSION OF CARBON STEEL. *Petroleum Processing* 2, 405-408 (1947) *June.*

The erratic nature of corrosion on carbon steel found in oil wells may be explained by the carbide structure theory. Corrosion took place in localized areas that were of spheroid crystalline structure. The corroded areas were bounded by a fine grained structure of a mixture of spheroidized and laminar types. The unaffected areas were made up of the laminar type. The spheroid structure took place after welding or upsetting operation when these areas have not been properly normalized nor annealed, otherwise the carbon steel would be of the regular laminar crystalline structure. These discoveries were further substantiated by subjecting carbon steel samples, one normalized and the other spheroidized, to severe corrosion tests in the laboratory. Although it was established that the structure of the carbide had a definite role in corrosion and welded and upset areas were susceptible to corrosion, further proof is necessary on the types of carbide crystalline structures that affect corrosion. Further work is also necessary on the effect of other steel alloys in light of the carbide structure theory.

S. Mori

Corrosion Prevention

Cotey, B. J. IS CORROSION TAKING $ $ FROM YOUR POCKET? *Oil Gas J.* 46, 68, 71, 92-93 (1947) *May* 10.

A chemical treatment is applied in oil wells to cut down corrosion rates. Since corrosion in oil wells is a surface phenomenon, proper application of a chemical that is oil insoluble builds a uniform protective film on the metal surface. A solution consisting of one gallon of chemical and four to five gallons of water is used; the volume used is 5 gallons per 1000 feet depth. The chemical, on contact with the metal, is strongly absorbed on the surface of the metal. The author does not disclose the type of chemical that was used nor the actual savings which would result from cutting down the frequency of tubing replacement, but he gives three case histories where the chemical treatment was used successfully. He also describes the manner of application of the chemical for different types of wells.

S. Mori

Corrosion Resistant Alloys

Morton, B. B. RESISTANCE OF SOME NICKEL-CONTAINING ALLOYS TO WEST TEXAS CRUDES. *Corrosion* 3, 23-24 (1947) *January.*

A study of alloys resistant to corrosion in the West Texas oil fields high in sulfides showed that Monel, nickel plated on steel, and for high

tensile strength requirements, K Monel, parts were nearly corrosive resistant; however, in an abrasive section where corrosion was also high, a new nickel alloy variety (8-10% Ni with 0.10% carbon maximum) appeared promising. In the field of refining, linings of vessels at temperatures above 500°F. were made of chromium-containing alloys, but below this temperature the corrosive action changed from dry to electrolytic form so that non-ferrous nickel alloys were used. Where the sulfur content was high, Ni Resist (15% Ni-5% Cu-2% Cr), S-Monel, and K-Monel at lower temperatures, and 18/8′ stainless, Inconel (80% Ni-13% Cr), Type 316 stainless (18% Cr-13% Ni-3% Co) above 500°F. were found satisfactory. The author mentions several other alloys which were used to resist other reactants used during refining processes.

S. Mori

Corrosion Testing

Schneider, W. R. CORROSION COUPONS AND PIPE LIFE PREDICTIONS — REVISION OF 1947. *Corrosion* 3, 209-220 (1947) *May.*

Removable steel plates 3″ x 6″ x 5/16″, called corrosion coupons, are buried in pairs in the vicinity of a pipeline at locations where they are potentially corrosive. One coupon measures the corrosive action due to the soil only, while the other measures both the soil corrosivity as well as corrosive action due to any stray currents in the pipeline. The data obtained by the annual study of series of coupons covering a period of years are used to estimate the probable life of the pipes, or to determine the economical feasibility of applying one of the different types of pipe protection available. The article describes briefly the procedures and equipment used for these tests. The coupons are usually left in the ground for a period of one year to take into account all the seasonal changes. Tests show that any pit depth measurements on coupons buried for a period of years may prove worthless. Although a rough estimate of pipe life may be made from calculations based on a single coupon, the result may vary considerably since it is necessary to make due allowance for the following factors and the accumulation of this data cannot be made from a single coupon: (1) Annual variation of soil corrosivity can only be determined by a series of coupons; (2) The pit depth rate decreases with the age of the pipe, so an activity factor as described in the article must be applied; (3) The pit depth on the pipe must be measured when the coupons are installed. These factors are illustrated in two tables. A plot on a log scale of pit depth against the years gives a straight lined curve if the soil corrosivity rate remains constant, and any effect produced on the pipe due to bonding, cathodic protection, or changes in the soil conditions will alter the slope of the curve. Finally, the author gives examples showing the correlation between calculated and actual pipe life.

S. Mori

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